Russian Desman (*Myogale moschata*) is sometimes used in this country for mantle-trimmings, but is more appreciated in America. The Desman of the Pyrenees (*M. pyrenaica*), which Mr. Poland confounds with that of Russia, is a much smaller and quite different animal.

We now come to the great group of Rodents, many of which supply their skins in enormous quantities for the benefit of mankind. Mr. Poland's list contains thirty-three species of this Order. The Beaver, formerly of such preeminent importance, is now much reduced in numbers, but 63,419 Beaver-skins were sold by the Hudson's Bay Company in 1891. Another Canadian Rodent, the Musquash (*Fiber zibethicus*), still ranges over the "north-west" in enormous armies, from three to four millions of their skins being obtained every year. In 1891 the Hudson's Bay Company alone sold 554,104 of them. Another much appreciated little animal of the Rodent order is the Chinchilla from the highlands of Chili and Bolivia. Its fur, which is remarkably soft and delicate, is principally used in England, France, and America. Several allied species of the peculiar South American family *Chinchillidæ* are also called by the general name of "Chinchilla."

Of the Leporidæ or Hare-family, which concludes the Rodents, the Polar Hare and the Common Rabbit supply the largest numbers of useful skins. Of the Russian or Polar Hare (*Lepus glacialis*)—one of the best-known denizens of Arctic latitudes—from 2,000,000 to 5,000,000 skins are said to be collected annually, mostly in their thick white winter coats. But Rabbit-skins are employed in much more enormous quantities. Since the great increase of this Rodent in Australia and New Zealand, where, as is well known, the Rabbit has become an awful pest, the number of its skins sent to London for sale from those colonies has increased year by year, until, according to Mr. Poland's calculations, from fifteen to twenty millions are now imported. Very large numbers of Rabbit skins are also brought to England from France, Germany, and other countries, mostly taken from domestic varieties.

The American "Buffalo" (more correctly "Bison") is extinct as regards trade purposes, so that we need not go into the quantities of "Buffalo-robes" formerly imported, which in Catlin's time reached 200,000 in the year; nor will the other species of the order Ungulata, of which Mr. Poland gives forty-six in his list as affording skins more or less used in commerce, detain us long. The most important of them are the different varieties of the domestic Sheep and Goat, which are spread all over the world and supply mankind with every variety of clothing-materials. The extent of this commerce is enormous. Of tanned Goatskins alone 7,259,212 were imported into this country in 1891, and 5,613,996 skins of "East Indian Sheep" were sold in London.

The Edentates, Marsupials, and Monotremes, with which Mr. Poland concludes his volume, are of small importance after the preceding orders. "Australian Opossum," however, under which common name are included skins of several different species and varieties of the genus *Phalangista*, forms an exception, as the annual supply of this article exceeds two million skins, which are much appreciated for their "cheapness, light weight, pretty colour, and general usefulness." Of Kangaroos of all sorts over 120,000 skins were imported in 1891, so that, what with these and the Phalangers and its twenty million Rabbit-skins, Australia has a fair share of this lucrative commerce. But altogether, no doubt, the Dominion of Canada and adjoining district of Alaska still get the lion's share of the traffic in "furs and pelts."

In concluding our somewhat lengthy notice of Mr. Poland's volume we may say that it is replete with information that a zoologist cannot obtain elsewhere in a convenient form, but at the same time contains many errors in the identification of the species, some of which we have pointed out. In a second edition, which will doubtless be called for, the author should obtain the assistance of a scientific expert. He would also do well to cut out of his list some of the less important species (such as the Dingo, Great Anteater, and Echidna), which are not really used for trade-purposes, and to bring up his statistical information under every head to the most recent date.

SPINAL NERVE—IMPULSES AND ELECTRO-MOTIVE CHANGES.

The Structure and Functions of the Brain and Spinal Cord. By Victor Horsley, B.S., F.R.C.S., F.R.S. (Griffin and Co., 1892.)

As stated in the preface, the present volume (being the Fullerian Lectures for 1891) discusses the spinal cord and ganglia alone, and is to be followed by two others, dealing respectively with the brain and with physiological psychology.

Most books of this character have to be considered in their relation to two classes of readers—those who are experts in its subject-matter and those who are not—a distinction that applies with special force to the outcome of Royal Institution lectures. We shall therefore take two readings of the volume before us.

The table of contents and a cursory glance at the text very soon bear out the author's modest remark that these lectures have no pretensions to form a monograph upon the subject of which they treat. Nor are they an elementary review of it (in the ordinary sense of these words), but rather a series of vignettes—historical, zoological, and speculative—relating to the nervous system. The historical lecture is interesting; the curious and hideous figure on p. 13, from a twelfth-century manuscript in the Bodleian Library, very aptly fulfils its purpose, viz., to demonstrate that no advance is there apparent upon the ideas of Aristotle. Prof. Horsley avoids plainly asserting that Sir Charles Bell discovered the sensory and motor functions of the nerve-roots; the statement is implied, not made; at first reading we think it is made, on second reading we recognize that it is not made, on third reading that it is positively implied. It is evident that Prof. Horsley has read Bell's original pamphlet, "Idea of a New Anatomy of the Brain" (1811);[1] he does not, however, go on to say that Bell's two roots (before 1824) were an anterior "cerebral" root, subserving motion and sensation, and a posterior "cerebellar" root serving to govern vital actions. The *principle* of localization in nerve-roots, far more clearly stated by Walker in 1809 and the facts demonstrated by Majendie in 1822, are not alluded to. In the second lecture Kleinenberg's cells are figured and described, and on the next page admitted to be mythical; thus Prof. Horsley is enabled legitimately enough to utilize this time-honoured if anatomically incorrect illustration to enforce the essentially correct principle of differentiation. Lecture III. treats of jelly-fish, star-fish, and cray-fish, with reference to rhythm, "localization" and co-ordination of movements. "Localization" is used as a term to denote a physiological property or function (pp. 48-49); *i.e.*, as used by psychologists to denote an act of the subject, rather than as used by physiologists to indicate observed relations between parts and functions. This use of the word is perfectly legitimate, but it is rather apt to create confusion of thought. "Localization" is sometimes used in a similar sense in relation to brain-function, and with a similar inconvenience; "localization" *by* the brain in a psychological sense is properly localization by the subject, localization *in* the brain is an object of physiological experiment. No doubt it may be said that psychological localization rests upon physiological differentiation and localization; none the less the use of the term to denote a physiological property or function is not advisable without very careful definition. Lecture IV. deals with vertebrates—nerve-fibres, gullet theory of canalis centralis, spinal cord, and nerve-roots. Lecture V. with ganglia. Here we must criticise. Looking to the class of readers addressed, Fig. 26 may be misleading as regards the anatomy of anterior and posterior roots. Fig. 28 (altered from Hirschfeld and Leveillé) is very confusing, and the anatomy of the brachial and lumbar plexuses is strange. A reader who should gather his notions of the functions of spinal ganglia from pp. 110-113 would have a very wrong idea of the state of our physiological knowledge; nor does the odd expression, "the immense discovery by Claude Bernard, of the so-called vaso-motor system of nerves," possess much justification as regards historical accuracy.[1]

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[1] Not an easy matter—we only know of one copy in London, that at the British Museum, misdated 1802—nor a superfluous matter, as any one knows who has compared the "reprints" of 1824 and of 1830 with the original paper in the Phil. Trans. of 1821 on the nerves of the face. Correct reprints of Bell's first paper have been published in "Documents and Dates of Modern Discoveries in the Nervous System," (? by A. Walker), London, 1839, and in the "Journal of Anatomy and Physiology" for 1869, by A. Shaw.

The four last lectures contain—necessarily mingled with familiar elementary considerations—a statement of the results arrived at by Professors Gotch and Horsley from their electrical investigation of nerve-impulses in afferent and efferent nerve-channels, and to the expert form the most important part of the book. We begin, therefore, to read more closely, still bearing in mind, as indeed is suggested by the style, the requirements of non-expert readers. Nothing arrests attention on the first two pages. On p. 129 we pause at this sentence:—"It is very interesting to see that the protoplasm of a nerve-conductor has a distinctly longitudinal arrangement, which, it is not going too far to suggest may, by virtue of this fact, be more adapted for the polarization of its molecules for the better transmission of nerve-impulses." Having dissected out the possible meaning of this sentence we proceed. Two pages further we are stopped for a moment by a confusion between the local excitability of nerve and its conductivity. On the next page (p. 132) we demur to the assertion that "secondary tentanus depends upon the electrotonic state of the first preparation." On page 138 we find no reason to accept the distinction that "no doubt may reasonably exist that active nerve yields products of oxidation, which doubt certainly exists as to the acidification of nerve." Both facts are possible but unproven; no proof whatever has been attempted of the first; the second has been investigated with positive and with negative results. Page 146 includes a figure in which the current is *not* shown as an action current, but the reverse; moreover, with the instrument figured (capillary electrometer), *no current* is under observation.

But these twenty pages are enough, and we shall have but little space to discuss what forms the main positive differentia between Prof. Horsley's book and other books of the same class, *i.e.*, the conclusions derived from electrical data.

The conditions of criticism in this connection are altogether different, and we need not stop to examine into the accuracy of elementary points. Prof. Horsley is now addressing himself to an expert audience; his reasoning and his data have yet to pass through the refining fires of doubt and of objection, with, it is to be hoped, ultimate confirmation. The principle of the method of investigation is a well-established one; we know that electrical variations are indicators of functional variations; in the spinal cord, as elsewhere, functional activity may therefore be roughly gauged by galvanometer or by electrometer. Gotch and Horsley did this as regards efferent channels and afferent channels; as regards the first they found by the electrometer that the character of discharge in the pyramidal tract does not differ from its character in motor nerves; as regards the afferent tract they find that impulses pass up the cord chiefly in the posterior column of the same side. These conclusions may be admitted without imprudence. But the conclusions that may not safely be admitted without further experimental elaboration, are those relating to the functional discharges (inferred from electrical discharges) up and down the anterior and posterior roots, and to the quantitative distribution of centripetal impulses in the various columns of the cord. As regards this second point the physical conditions are not sufficiently analyzed (either in this volume or in the original paper) for us to admit, *e.g.*, that average galvanometric swings of 60 and 20 indicate a passage of afferent impulses in the proportions 60 and 20 per cent. in the posterior and in the lateral columns respectively. That the deflection was proportional to the number of fibres excited, is an assumption requiring proof (p. 212, *cf.* also pp. 145, 159, 160).

As regards the first point, it was found that electrical discharges pass easily *down* as well as *up* the posterior root, but are "blocked" *up* the anterior root, and diminished *down* that root. But in the inferences *qua* functional impulses derived from these data, two considerations appear to have been insufficiently borne in mind—(1) The rapid death of interrupting grey matter as compared with the endurance of white matter, and (2) the disproportionate magnitude of negative variations by *electrical* excitation as compared with negative variations by *functional* excitation. The contrast between interrupted and non-interrupted tracts, as regards the transmission, gauged electrically, may have been in part due to the first cause, and an adequate recognition of the second fact would have withheld Prof. Horsley from expressing astonishment—"a revelation to us" is his phrase—at finding the electrical variation in a nerve eight or ten times as great by direct electrical excitation as by discharge of a nerve centre. Du Bois-Reymond's analogous deflections obtained on strychninized frogs were 1° to 4° *versus* 40° by direct electrical excitation. A functional discharge *down* posterior roots, if proved to occur, is a new and surprising phenomenon; but its existence is not *at present* proved by the existence of an electrical discharge; electrical effects by electrical excitation are tainted evidence, electrical effects down the posterior roots by functional excitations above, although incidentally touched upon, were not exhaustively examined, and considering the recognized dangers of experimental fallacy, we may not admit as proved that nervous impulses are discharged down afferent channels. Prof. Horsley infers unreservedly that functional discharge occurs *down* the posterior roots, and that centripetal impulses *up* the anterior roots are blocked at the cord. This he regards as striking evidence of the truth of the kinæsthetic doctrine (*i.e.*, that nerve action starts from the afferent or sensory side of the nerve centre, p. 170); but the connection between this presumed functional downflow in afferent channels and kinæsthesis is not made apparent; up-flow in afferent channels is matter of common knowledge; up-flow by efferent channels has (so far as we know) been contended for by no one since Lewes. But as regards these last points, they may be expected to receive fuller and more precise analysis in the promised volumes on the brain and on physiological psychology.

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[1] In point of time Brown-Séquard is the true discoverer of vaso-motor nerves. Bernard's experiments were made subsequently, and interpreted otherwise.

"D'après ces expériences, il n'est donc pas possible d'expliquer le réchauffement des parties par une prétendue paralysie des artères, qui, à raison d'un élargissement passif, laisseraient circuler une plus grande quantité de sang. . . . .

"Si alors [*i.e.*, en galvanisant] les artères, comme les veines, se ressèrent et reviennent sur elles-mêmes, çela tient à ce qu'il n'y a plus de sang pour les distendre, mais ce n'est pas du tout l'effet d'un resserrement actif des vaisseaux.

. . . . . "il ne peut venir à l'idée de personne de penser à rapporter [le phénomène circulatoire qui succède à la section du nerf sympathique] à une paralysie pure et simple des artères." Bernard, *Annales des Sciences Naturelles*, 1854, p. 198.)

A. D. W.

ELECTROTECHNICAL TRAINING.

Electrical Engineering as a Profession and How to Enter It. By A. D. Southam. (London: Whittaker and Co., 1892.)

THIS book consists of a collection of extracts from the notices of various firms regarding apprentices and articled pupils, and from the prospectuses of colleges which give an education in electrical engineering. It reminds us of the gorgeous but depressing volumes one has met so often in one's summer outing, containing particulars of hotels in Aden, hotels in Algiers, hotels in Andermatt, &c., each hotel possessing, at least so it is said in the gilt-edged page advertisement, every possible attraction—a magnificent view, a first-rate cuisine, electric light, ascenseur, and all the other dreariness of a bandboxy barrack.

First we thought that the length of description which the author had given to a particular technical educational establishment was a measure of its goodness, but that idea we dismissed when we found that only three pages of description were given to that technical college in South Kensington, regarding which the author says: "This institution deservedly stands at the head of all the technical institutions in this country." Next it occurred to us that the author might have acted on the "good wine needs no bush" principle; but that hypothesis had to follow the other, for we feel sure that the Walker Engineering Laboratory at Liverpool is not bad, and yet it requires fifteen pages of talking about. Then we wondered whether each professor had been asked to write as much as he liked, so that the length of the description of a particular set of laboratories was in proportion to the leisure of the writer; and lastly, we have been speculating whether the likeness to the "Hotels of the World" book might not be quite complete, and the length of the description was a measure of the length of the purse of the advertiser.

However, be the plan of the compilation what it may, the book contains a good deal of information, also some salutary advice with which we quite agree:—"Undoubtedly the best training for a young man entering the electrical profession is to go through the course at one of the technical schools or colleges, and then when thoroughly grounded in the theory and having a general idea of the practice of his profession, to be articled for some months to a good firm of electrical engineers, where he will be able to acquaint himself with the practical part of his business as actually carried out on commercial principles;" and again, "if he then goes to both a Technical College and is also articled, it is advisable that the former should precede the latter, for the reason that when he is placed in the workshop his previous technical training will enable him to appreciate and see the importance of much which he would otherwise have overlooked."

For the fathers who desire to place their sons directly in a works on leaving school, there is given a long list of engineering firms who are willing to receive £300 and the lad; some are willing to take only one hundred and twenty guineas a year, from year to year, or even as little as £100 a year—and the lad. In many cases a month's trial is allowed, but judging from the ignorance of elementary mathematics and science displayed by many articled pupils in works, we presume that either these subjects are not required, or a month is not a long enough time for this astonishing ignorance to be discovered. Naturally enough these firms do not bind themselves to provide work for these articled pupils when their term is finished; indeed we know of a firm with over 100 articled pupils which is applying elsewhere for an assistant.

When will the parental idea die out that a lad who is pitchforked into a works must turn out an engineer? No doubt many of our successful engineers never received any education in a technical college; so many of our battles were won by men armed only with bows and arrows, but that is no reason for confining the equipment of a modern regiment to these primitive weapons. Either the teaching given at a technical college materially helps the lad in his subsequent practice in the works, or it is a fraud and ought to be stamped out. If it affords real help